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## 9)Lattice Dynamical Theory of Sinusoidal Antiferroelectricity in Thiourea

AUTHOR(S):

YOSHIMITSU, Koji

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It should be noted that, for zone boundary soft modes such as in  $SrTiO_3$  the central peak should results from another reason because the concept of the hydrodynamic mode becomes meaningless for such large momentum. In such a case non-linear coupling to hydrodynamic modes or non-linear effects of critical fluctuations, or effects of crystal imperfections would lead to the central peak as have been discussed by several authors.

The detailed calculations are now in progress and those accounts will be published elsewhere.

## Lattice Dynamical Theory of Sinusoidal Antiferroelectricity in Thiourea

Kôji YOSHIMITSU

Department of Physics, Kwansei Gakuin University

It has been known through an analysis of the observed satellites in X-ray scattering that thiourea has sinusoidal antiferroelectric polarization along c-axis in the phases II–IV. It is also suggested that this sinusoidal structure is caused by the condensation of a soft mode with a special wave length and polarization.

A model is proposed to interpret the existence of such a soft mode. Dipolar and quadrupolar interaction between thiourea molecules are taken into consideration together with simplified short range repulsive interactions and the dynamical matrix for molecular rotational vibration is set up and dispersion relations are derived. It is shown that softening of a mode with a sinusoidal polarization is expected to exist and possible temperature effect may account for the observed behaviour in thiourea.

The detailed calculations will be published in Prog. Theor. Phys..